



Multiple factors predict longer and shorter time-to-ulcer-free in people with diabetes-related foot ulcers: Survival analyses of a large prospective cohort followed-up for 24-months

Yuqi Zhang^{a,b,*}, Susanna Cramb^{a,b,c}, Steven M. McPhail^{a,d}, Rosana Pacella^e,
Jaap J. van Netten^f, Qinglu Cheng^g, Patrick H. Derhy^h, Ewan M. Kinnearⁱ, Peter A. Lazzarini^{a,i},
on behalf of the Diabetic Foot Working Group, Queensland Statewide Diabetes Clinical Network,
Australia¹

^a Australian Centre for Health Services Innovation & Centre for Healthcare Transformation, School of Public Health and Social Work, Queensland University of Technology, Brisbane, Australia

^b Centre for Data Science, Queensland University of Technology, Brisbane, Australia

^c Jamieson Trauma Institute, Royal Brisbane and Women's Hospital, Metro North Health, Brisbane, Australia

^d Clinical Informatics Directorate, Metro South Health, Brisbane, Australia

^e Institute for Lifecourse Development, University of Greenwich, Greenwich, London, UK

^f Amsterdam UMC, University of Amsterdam, Department of Rehabilitation Medicine, Amsterdam Movement Sciences, Meibergdreef 9, Amsterdam, the Netherlands

^g Kirby Institute, University of New South Wales, Sydney, Australia

^h Clinical Access and Redesign Unit, Queensland Health, Brisbane, Australia

ⁱ Allied Health Research Collaborative, The Prince Charles Hospital, Brisbane, Australia

ARTICLE INFO

Keywords:

Cohort study
Cox proportional hazard model
Diabetic foot
Diabetes-related foot ulcer
Flexible parametric survival model
Ulcer-free

ABSTRACT

Aims: To investigate factors independently associated with time-to-(being)-ulcer-free, time-varying effects and predict adjusted ulcer-free probabilities, in a large prospective cohort with diabetes-related foot ulcers (DFU) followed-up for 24 months.

Methods: Patients presenting with DFU(s) to 65 Diabetic Foot Services across Queensland, Australia, between July-2011 and December-2017 were included. Demographic, comorbidity, limb, ulcer, and treatment factors were captured at presentation. Patients were followed-up until ulcer-free (all DFU(s) healed), amputation, death or two years. Factors associated with time-to-ulcer-free were investigated using both Cox proportional hazards and flexible parametric survival models to explore time-varying effects and plot predicted adjusted ulcer-free probability graphs. **Results:** Of 4,709 included patients (median age 63 years, 69.5% male), median time-to-ulcer-free was 112 days (IQR:40–730), with 68.4% ulcer-free within two years. Factors independently associated with longer time-to-ulcer-free were each year of age younger than 60 years, living in a regional or remote area, smoking, neuropathy, peripheral artery disease (PAD), ulcer size >1 cm², deep ulcer and mild infection (all $p < 0.05$). Time-varying effects were found for PAD and ulcer size limiting their association to six months only. Shorter time-to-ulcer-free was associated with recent DFU treatment by a podiatrist and receiving knee-high offloading treatment (both $p < 0.05$). Predicted adjusted ulcer-free probability graphs reported largest differences in time-to-ulcer-free over 24-months for geographical remoteness and PAD factors.

Conclusions: Multiple factors predicted longer and shorter time-to-ulcer-free in people presenting with DFUs. Considering these factors, their time-varying effects and adjusted ulcer-free probability graphs, should aid the prediction of the likely time-to-(being)-ulcer-free for DFU patients.

Abbreviations: DFU, diabetes-related foot ulcer; PAD, peripheral artery disease; QHRFF, Queensland High Risk Foot Form; HR, hazard ratio; IQR, interquartile range; CI, confidence interval.

* Corresponding author at: School of Public Health and Social Work, Queensland University of Technology, Brisbane, Australia, 60 Musk Ave Kelvin Grove, QLD 4059, Australia.

E-mail address: yuqi.zhang@hdr.qut.edu.au (Y. Zhang).

¹ Membership of the Diabetic Foot Working Group, Queensland Statewide Diabetes Clinical Network (Australia) is provided in the Acknowledgments.

<https://doi.org/10.1016/j.diabres.2022.109239>

Received 14 September 2021; Received in revised form 27 January 2022; Accepted 1 February 2022

Available online 4 February 2022

0168-8227/© 2022 Elsevier B.V. All rights reserved.